

REMARKS

Claims 37, 39, 41, 46, 47 and 52 have been amended to improve form, claims 38, 43-45 and 55 have been canceled without prejudice or disclaimer and new claims 56 and 57 have been added. Claims 37, 39-42, 46-54, 56 and 57 are now pending in this application.

Claims 37-39 and 41-44 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Fried et al. (U.S. Patent No. 6,583,469; hereinafter Fried); claims 40 and 48-55 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Fried; and claims 39 and 44-47 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Fried in view of Yeo et al. (U.S. Patent No. 6,855,990; hereinafter Yeo). The rejections are respectfully traversed.

Claim 37, as amended, recites that the semiconductor device includes a dielectric layer comprising hafnium formed on the top surface and side surfaces of the conductive fin in the channel region of the semiconductor device. A similar feature was previously recited in claim 45. As to this feature, the Office Action admits that Fried does not disclose or suggest this feature, but states that Yeo discloses a semiconductor device having a fin with an overlying gate in which the gate dielectric layer comprises a high dielectric constant material, such as hafnium oxide and points to Fig. 2 and col. 3, lines 20-39 and col. 7, lines 4-15 for support (Office Action – page 4). The Office Action further states that it would have been obvious to substitute a material comprising hafnium for the gate dielectric layer of Fried (Office Action – pages 4-5). The applicants respectfully disagree.

Fried discloses utilizing a conventional thermal growth process to form the gate dielectric. Fried further discloses that the thermal growth process may include an oxidation, nitridation or oxynitridation (Fried – col. 6, lines 30-35). Such a process clearly is not compatible with forming a gate dielectric layer that comprises hafnium. Yeo may disclose forming a gate dielectric layer that comprises hafnium. However, the Office Action has not provided any objective motivation as to why it would have been obvious to replace a conventional thermal growth process used to form a gate dielectric in Fried with a process that includes forming a gate dielectric layer that comprises hafnium. The Office Action merely states that it would have been obvious and does not point to any portion of either reference as providing objective motivation for modifying Fried to include the feature of Yeo (Office Action – page 5). The applicants respectfully assert that it would not have been obvious to modify Fried to include features from Yeo due to the incompatible nature of the process disclosed by Fried and that disclosed by Yeo. In other words, Fried specifically discloses forming a gate dielectric layer using a thermal growth process. Using a thermal growth process to form a dielectric layer is not at all similar to forming a dielectric layer comprising hafnium, as disclosed in Yeo. Therefore, the applicants respectfully assert that it would not have been obvious to combine features from Yeo with Fried absent impermissible hindsight.

Claim 37, as amended, also recites that the metal gate has a thickness ranging from about 700 Å to about 2,000 Å. This feature is similar to a feature previously recited in claim 43. The Office Action states that Fried discloses forming a metal gate on the insulating layer and points to col. 6, lines 39-52 and col. 3, line 55 to col. 4 for support (Office Action – pages 2-3). Fried may disclose forming a gate electrode 32 as illustrated

in Fig. 18B. Fried, however, is totally silent with respect to the thickness of gate electrode 32. Absent some disclosure with respect to the thickness of gate electrode 32 in Fried, the applicants assert that Fried cannot be fairly construed to disclose or suggest that gate electrode 32 is formed to the range recited in amended claim 37. Yeo also does not disclose or suggest this feature.

For at least the reasons discussed above, the combination of Fried and Yeo does not disclose or suggest each of the features of amended claim 37. Accordingly, withdrawal of the rejection and allowance of claim 37 are respectfully requested.

Claim 40 is dependent on claim 37 and is believed to be allowable for at least the reasons claim 37 is allowable. Accordingly, withdrawal of the rejection and allowance of claim 40 is respectfully requested.

Claims 41 and 52, as amended, recite features similar to claim 37. For reasons similar to those discussed above with respect to claim 37, withdrawal of the rejection and allowance of claims 41 and 52 are respectfully requested.

Claims 42 and 46-51 and claims 53-54 depend on claims 41 and 52, respectively, and are believed to be allowable for at least the reasons their independent claims are allowable. In addition, these claims recite additional features not disclosed or suggested by the cited art.

For example, claim 47 recites that the dielectric layer comprises HfSiO. Yeo discloses forming a dielectric layer using HfO₂ or HfON (Yeo – col. 3, lines 31-34). Yeo does not disclose that the dielectric layer comprises HfSiO. For at least this additional reason, withdrawal of the rejection and allowance of claim 47 are respectfully requested.

Claim 49 recites that the metal gate comprises a titanium nitride and claim 51 recites that the metal gate comprises a tantalum nitride. The Office Action admits that Fried does not disclose using either of these metals, but states that it would have been obvious to use these metals since they are conventionally used to form gate electrodes (Office Action – page 4). The applicants respectfully disagree.

Claims 49 and 51 recite that the gates comprise specific materials for a semiconductor device that includes a silicon fin. Therefore, even if, for the sake of argument, the materials recited in claims 49 and 51 are used to form gate electrodes for conventional MOSFET devices, the applicants assert that such materials are not conventionally used to form gates for a semiconductor device that includes a silicon fin, as required by claims 49 and 51. The applicants further assert that it would not have been obvious to use such materials based on the disclosure of Fried or Yeo.

For at least these additional reasons, withdrawal of the rejection and allowance of claims 49 and 51 are respectfully requested.

NEW CLAIMS

New claims 56 and 57 have been added. These claims recite features similar to claims 49 and 51. For reasons similar to those discussed above, the cited art of record does not disclose or suggest these features. Accordingly, allowance of claims 56 and 57 are respectfully requested.

CONCLUSION

In view of the foregoing amendments and remarks, the applicants respectfully request withdrawal of the outstanding rejections and the timely allowance of this application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1070 and please credit any excess fees to such deposit account.

Respectfully submitted,

HARRITY & SNYDER, L.L.P.

By:



Glenn Snyder
Registration No. 41,428

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11350 Random Hills Road
Suite 600
Fairfax, Virginia 22030
(571) 432-0800